Preprint
UCRL-JC-143550

Isotopic Tracing of Fuel Components in Emissions from a Diesel Engine

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This article was submitted to
222nd National Meeting of the American Chemical Society
Chicago, IL
August 26-30, 2001

April 19, 2001

U.S. Department of Energy

Lawrence
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Laboratory

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Isotopic tracing of fuel components in emissions from a diesel engine

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Accelerator mass spectrometry (AMS) measured the relative contribution of ethanol to engine particulate matter (PM) from four ethanol-diesel blended fuels using contemporary grain alcohol as a tracer in low ^{14}C diesel fuel. An emulsifier (Span 85) or cosolvent (butyl alcohol) facilitated mixing of the 12-25% ethanol blends. We operated the laboratory test engine, a 1993 Cummins B5.9 diesel, at a steady-state medium load and collected PM samples on pre-combusted quartz filters following dilution of engine exhaust in a mini-dilution tunnel. The ethanol blends emitted less PM and NOx than the control. The cosolvent blends reduced PM more effectively than the emulsified blends with similar oxygen content. The distribution of the oxygen, not just the quantity, was an important factor in reducing PM emissions. Any bio-derived fuel component is easily traced on the fossil background. Schemes for measuring volatile fractions of soot and gaseous emissions can be implemented. Part of this work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.

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